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**AUSTERE MANNING IN THE GUIDED MISSILE
FRIGATE (FFG 7 CLASS): LESSONS LEARNED**

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**NAVY PERSONNEL RESEARCH
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**AUSTERE MANNING IN THE GUIDED MISSILE
FRIGATE (FFG 7 CLASS): LESSONS LEARNED**

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A deficiency in early system planning was the failure to consider projected manpower availability for critical skill areas.

The attempt to design systems for austere manning can result in low tolerance of the system for degradation to personnel levels, especially highly skilled personnel in short supply.

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FOREWORD

This effort was conducted in response to a request from the Chief of Naval Material to develop a presentation detailing the Navy's attempt to reduce manning of the Oliver Hazard Perry class guided missile frigate (FFG 7).

Material in this report expands upon materials presented to representatives of the Chief of Naval Operations (OP-11), the Chief of Naval Material (NMAT-08), and the Commander, Naval Sea Systems Command (NSEA-90) in October 1980.

Appreciation is expressed to Mr. K. Purdy of the Naval Sea Systems Command (PMS-399) for his assistance and cooperation.

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SUMMARY

Problem

A manning constraint imposed upon designers and developers of the Oliver Hazard Perry Class guided missile frigate (FFG 7) influenced equipment design, support and maintenance strategies, training requirements, and ship organization. The targeted level of manning for this ship has been increased, and it now appears that fleet manpower supply, training capabilities, and logistic support elements may not be adequate to support these ships.

Objective

The objective of this work was to determine how the manning constraint affected the FFG 7's design, maintenance strategies, training requirements, and ship organization, and to identify problems caused by this constraint.

Approach

FFG 7 acquisition program documents and other major sources of information were reviewed. Interviews were conducted with program managers, analysts, decision makers, Navy personnel, and representatives of the training and support communities. Interview questions concerned program assumptions, ship design features, manning implications, and the ship's ability to meet mission requirements.

Results

1. The most serious impact of the manning constraint was the limitation of the number of personnel accommodations to 185. The platform sponsor recently directed an increase in the number of accommodations from 185 to 215. The cost of retrofitting the existing ships to meet this increase will be in excess of \$2.4 million per ship.

2. Because of the FFG 7's high level of automation and gas turbine propulsion system, crew members must be better trained and more experienced than are those on more conventional ships. Consequently, the FFG 7's crew has an unusually high ratio of rated to nonrated personnel.

3. The maintenance strategy, while designed to reduce manpower requirements, places a more stringent demand on support activities such as shipyards and tenders. Logistic support for this new ship class is more complex and demanding than that for a similar, more traditionally designed ship.

4. Because of the high ratio of rated to nonrated personnel, opportunities for training and career progression are restricted. It is projected that the shortfall of qualified FFG 7 personnel will become particularly acute in the period following final ship delivery. This shortfall will occur because insufficient attention was given to personnel and training supply projections.

Conclusions

1. The decision to limit the number of accommodations to 185 was premature and did not allow for the changes that inevitably occur during design and development.

2. The assumption that each ship would be fully manned by thoroughly trained personnel was unrealistic. At present, newly delivered ships cannot be manned with enough trained and qualified personnel.

3. A capability for providing accurate manpower supply projections early in the design/development process is essential for sound acquisition and design decisions.

Recommendations

1. Force planners and acquisition managers should develop and apply manpower projection techniques that consider the Navy's competing demands for manpower.

2. Designers should consider the development of a built-in antiair warfare simulator for the FFG 7 Combat Information Center.

3. The training establishment should analyze all onboard training needs and augment, where appropriate, the FFG 7's onboard training capability.

4. The shore training establishment should reexamine the FFG 7's training requirements and take steps to ensure that enough fully trained personnel are made available to each ship upon delivery.

5. The Navy should continue to monitor and evaluate the FFG 7 situation closely. A plan of action and milestones should be developed for this purpose.

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INTRODUCTION

Problem and Background

The Oliver Hazard Perry class guided missile frigate (FFG 7) is expected to comprise approximately 20 percent of the United States Navy's surface combatants in 1988. Today, 8 years after contract definition, 6 ships have been delivered, 10 are being tested, 1 is undergoing post-shakedown availability, and 43 are being constructed under contract.

From the beginning of the preliminary design phase to the present, considerable emphasis has been placed on reducing ship manning. A manning and accommodation constraint levied early in the acquisition program influenced equipment design, support and maintenance strategies, training requirements, and ship organization. Since the targeted level of manning for this ship has been increased, it now appears that the fleet manpower supply, training capabilities, and logistic support elements may not be adequate to support the FFG 7s. While the full impact of the manning constraint cannot be determined for some time, it is important to identify and correct problems that have been generated.

Objective

The objective of this work was to determine how the manning constraint affected the FFG 7's design, maintenance strategies, training requirements, and ship organization, and to identify lessons learned from this acquisition effort.

APPROACH

Pertinent documents were reviewed and selected personnel were interviewed during 30 days in August and September 1980. The documents reviewed included early manpower analyses, ship manning documents (SMDs), directives and guidance from the Chief of Naval Operations (CNO), and many files and publications obtained from the FFG 7 project office (PMS-399) (e.g., Knight-Ridder, 1980; Light, 1977; Nauta, 1978; U.S. Department of the Navy, 1975, 1979, 1980).

Interviews were conducted with program managers, analysts, decision makers, Navy personnel on three FFG 7 class ships (FFG 9, FFG 10, and FFG 12), and representatives of the maintenance, support, and training establishments. The following organizations were contacted:

1. Chief of Naval Education and Training.
2. Chief of Naval Technical Training.
3. Destroyer Squadron Nine.

4. Naval Surface Force, Pacific Fleet.
5. Fleet Introduction Team, San Pedro.
6. Fleet Combat Training Center, Atlantic, FFG 7 Class Combat Systems Trainer Group.
7. USS WADSWORTH (FFG 9), USS DUNCAN (FFG 10), and USS GEORGE PHILLIP (FFG 12).
8. Naval Electronics Systems Engineering Center, San Diego.
9. Naval Supply Center, San Diego.
10. Naval Sea Systems Command, Deputy Commander, Surface Combatant Ships Directorate (NSEA-93).
11. Long Beach Naval Shipyard.
12. Great Lakes Service School Command, Naval Training Center.
13. Deputy Chief of Naval Operations, Surface Warfare Division, Destroyer Acquisition Fleet Introduction (OP-321G1).
14. Naval Sea Systems Command, Guided Missile Frigate (FFG) Ship Acquisition Project (PMS-399) and Ship Improvement Project (PMS-306).
15. Shore Intermediate Maintenance Activities (SIMAs), Mayport and San Diego.

Some of the major questions discussed during the interviews were:

1. What assumptions were made to meet the manning constraint?
2. Are the assumptions being realized and were they realistic?
3. What was the impact of the manning constraint on equipment decisions, support and maintenance strategies, organizational structure, and training requirements?
4. Can this ship class meet mission requirements with approved SMD manning?
5. Can this ship class meet mission requirements with "fair share" manning?¹
6. Will the maintenance strategy work?

The answers to these and other questions were reviewed and synthesized.

¹Fair share manning, often referred to as the Navy Manning Plan (NMP), means manning levels below those specified in the SMD, which result from the attempt to equitably distribute limited manpower resources among units competing for them. Generally, the result is that lower priority units receive a fraction of their required manpower complements for skill areas that are in short supply. The Navy usually attempts to compensate for the deficiency by supplying additional lower rated personnel.

FINDINGS

The Manning Constraint

Early manning estimates for the FFG 7 class ships ranged from 213 to 231 officers and enlisted. These estimates, which were based on traditional manning concepts regarding watchstanding, maintenance, and other ship's work and were derived from standard computational procedures, were reviewed in 1971 in an effort to reduce manning. The need for each billet was challenged and a new estimate of 185 was presented to the CNO. After reviewing the ship's intended mission and projected costs, CNO limited the number of accommodations to 185.

As a result of this decision, the Ship Acquisition and Program Manager (SHAPM) developed and employed innovative manning, equipment design, maintenance, and ship organizational concepts. SHAPM also prepared backup designs for the addition of 12, 18, or 30 accommodations.

As the design features of the ship changed, the manpower requirements were gradually increased. In August 1980, following a class manpower validation study by the Navy Manpower and Material Analysis Center, Atlantic, CNO approved the FFG 7 class SMD, which specified a manning level of 192 (12 officers, 15 CPOs, and 165 enlisted, excluding the Aviation Detachment). Also in 1980, the platform sponsor directed the addition of 30 accommodations, seven for the immediate increase in SMD manning and 23 for future growth.

SHAPM Assumptions

In the process of developing the FFG 7, SHAPM made several assumptions concerning ship design features, maintenance strategies, and manning concepts. The first of these, that the ship would be 100 percent manned in quantity and quality, was approved for the lead ship by VCNO in October 1975. The other assumptions were that (1) all personnel would be fully trained for assigned billets upon reporting aboard, (2) personnel assignment and training structures would be in place and operational upon ship delivery, and (3) the fleet would accept the reduced watchstanding requirements and remote control/monitoring concepts. At present, none of these assumptions has been fully realized.

Design, Selection, and Arrangement of Equipment

The manning constraint influenced equipment design, selection, and arrangement. However, except for the limit on personnel accommodations, it did not drive design.

Several design features reflect the emphasis on increased efficiency and reduced manpower. First, the work area on the bridge is smaller than that on similar ships. Functions on the bridge, in the Combat Information Center (CIC), and in ship's offices have been partially automated. Equipment has been modularized to facilitate a pull-and-replace maintenance strategy. Vertical, unobstructed paths for rapid, efficient equipment removal have been provided. Equipment and work areas have been consolidated according to function, and low maintenance materials and labor-saving devices have been included in the design.

The physical design features of this ship seem to contribute to efficient and effective manpower utilization and to improved habitability. However, with two exceptions, there

is no evidence that total ship manning levels have been reduced through design. These exceptions are (1) the apparent reduction in bridge watchstanders attributed to the smaller bridge with increased automation and (2) the selection of the LM-2500 gas turbine propulsion system, which presumably requires fewer personnel to operate and maintain than a conventional steam plant. While these systems do reduce manpower requirements, more skilled and better trained personnel are required to operate and maintain them because of their increased sophistication. Further, the systems have a lower tolerance for personnel shortages and deficiencies.

Maintenance Strategy and Concepts

Shipboard maintenance had to be minimized to be consistent with the reduced manning goal. At the same time, cost and ship displacement constraints limited the investment that could be made in shipboard maintenance facilities. It was determined that conventional maintenance strategies could not satisfy the FFG 7 class ship manned at the CNO targeted level. To meet the manning ceiling requirements as well as an additional requirement for greater-than-normal at-sea utilization, newly developed maintenance and support concepts were planned.

The progressive overhaul concept is central to the FFG 7 maintenance strategy. Under this concept, prescribed and discrete maintenance actions will be performed during scheduled intermediate availabilities (3 weeks every 6 months) and selected restricted availabilities (4 weeks every 2 years). Thus, the ship will undergo continuous overhaul. Shore and tender support activities have been designated and it appears that they will have the required personnel, equipment, and spares needed for implementation. Responsibilities and detailed maintenance actions of support organizations for depot and intermediate maintenance are described in the class maintenance plan and the FFG 7 class ship plan for use (U.S. Department of the Navy, 1978).

The maintenance strategy also includes the following concepts, which are integrally related to ship and system design:

1. Equipment will be replaced by ship's force before failure.
2. Failed modules will be repaired off-ship and rotatable pools of modularized equipment will be used.
3. Reliability and maintainability will be improved.
4. FFG 7 class contractor-furnished and government equipment will be standardized.
5. Maintenance will be reliability-based.

The assumptions underlying the approach to FFG 7 maintenance were that:

1. Organizational level maintenance workload will be reduced.
2. Shore and tender support equipment, facilities, and personnel can meet the FFG 7 depot and intermediate level maintenance demands during planned availabilities, given the other demands placed on them.

3. The supply system can acquire, transport, and position sufficient parts and modules.

It is estimated that a savings of approximately 400 man-hours per week can accrue as a result of implementing the various concepts discussed. However, since there have been changes to the original equipment and organizational level planned maintenance tasks are currently being revised and evaluated, actual savings cannot be computed at this time.

Interviews conducted with WADSWORTH, DUNCAN, and GEORGE PHILLIP personnel reveal that the ships can meet current organizational level maintenance requirements with the assigned personnel. Personnel reported that they felt that parts and spare modules may not be available, and cited several instances of inability to obtain spare modules for failed equipment.

The SIMAs designated to support the FFG 7s have not yet obtained personnel with the unique skills required to maintain FFG 7 equipment. However, SIMA personnel feel that they will be able to satisfy FFG 7 demands in the future.

Personnel at both depot level and intermediate level maintenance activities expressed the view that FFG 7 maintenance requirements can be met if sufficient spare modules and parts are supplied as planned. The supply system, according to personnel interviewed, is a high risk and key element of the maintenance strategy for the FFG 7. Supply organization representatives indicated that they anticipate no major problems in meeting scheduled supply requirements.

In summary, it can be said that:

1. The manning constraint influenced the development of the maintenance strategy and concepts.
2. The maintenance and support systems comprise a complex network upon which the FFG 7 must rely to achieve material readiness.

Manning Concepts, Onboard Training, and Career Paths

Manning Concepts

Several new manning concepts were developed to meet the manning constraint:

1. Several Condition III watch stations were eliminated.
2. Some enlisted billets were assigned additional responsibilities and persons assigned to these billets were designated as division officers.
3. The gas turbine specialist (GS) rating was assigned to the ship.
4. Nonrated personnel were organized into dedicated groups for performing facilities maintenance, ship control, and mess deck duties.

The result was an efficient manpower design, but one which decreased the tolerance for degradation to the quantity or quality of the ship's personnel complement.

The increased complexity of equipment and the employment of the new manning concepts combined to create a situation in which (1) more highly skilled personnel are needed, (2) the ratio of rated to nonrated personnel is greater than on conventionally manned ships, and (3) there are fewer trainee and striker billets.

For these reasons, the SHAPM made the previously stated assumption that the FFG 7 class ships would be fully manned with adequately trained personnel upon ship delivery. In fact, however, due to fleet manpower supply shortfalls and policies established for priority manning, these assumptions could not be met. Figure 1, which shows the projected demand and supply for personnel in the gas turbine specialist (mechanical) (GSM) rating, illustrated, in part, the reason for this. In 1982 the major demand for the GSM rating will come from the DD 963 and FFG 7 class ships. The only way to fully man the FFG 7 with GSMs is to reduce the supply for the DD 963s (given no change to the GSM supply rate, which hinges on such factors as recruitment, retention, and extensive training).

Similar situations arise in the operations specialist (OS) and electronics technician (ET) ratings. Over the decade encompassing the design and acquisition of the FFG 7, the manpower supply situation has worsened and the demand for more highly qualified personnel has risen. The personnel pipeline is long and cannot be instantly filled.

<u>FY 1982</u>		
<u>GSM PETTY OFFICERS</u>		
<u>1982 DEMAND</u> <u>(PROJECTED)</u>		<u>1982 SUPPLY</u>
FOR 30 DD 963s	= 570	TOTAL ~ 480 (65%)
FOR 24 FFG 7s	= <u>168</u>	
TOTAL	738	PROJECTED SHORTFALL ~ 258 (35%)
<u>TRADE OFF</u>		
100% MANNING FOR FFG 7 = 55% MANNING FOR DD 963		
GIVEN NO CHANGE TO PROJECTED SUPPLY		

Figure 1. Projected demand and supply for personnel in the GSM rating.

Onboard Training

FFG 7s have a higher need, but a more limited capability, for onboard training than do more conventionally designed and manned ships, where the discrepancy between the skill requirements and supply is reduced by training and upgrading personnel in striker rates. On the FFG 7, the required skill levels are high and the striker base is relatively low. There is less time for higher rated personnel to train the lower rated personnel and for the lower rated personnel to attend training. The FFG 7, therefore, will require stronger support from the shore-based training establishment than will other ships.

Interviews with key personnel in the training community revealed that they did not foresee a requirement to treat training for the FFG 7 any differently than training on other ships or to train FFG 7 personnel to a higher level of proficiency than personnel being trained for other ship classes. If it is true that the FFG 7 has a limited capability to develop and train assigned manpower resources and the shore-based training community will not treat training for this ship differently, the ship's onboard training capability will probably need to be augmented, particularly in CIC, which has a requirement for team performance and highly perishable skills. Shipboard CIC training requires a capability to stimulate the CIC system to provide on-line practice, especially for antiair warfare (AAW) operations. During interviews, commanding officers and executive officers of FFG 7 class ships unanimously agreed that such a capability was desirable, particularly for use at sea.

Career Paths

The fact that there are more career paths for FFG 7 enlisted personnel than can be filled will lead to a loss of FFG 7 related skills in the future. The problem stems from the distribution of pay grades under the present manning concept.

Compared to similar ships, the FFG 7 has fewer personnel but proportionately more personnel in higher grades. Initially, this can be viewed as a benefit because of the smaller overall demand placed on the Navy manpower pool. Later, however, this can become a liability because there are disproportionately fewer personnel in the low grades at the bottom of the career progression ladder--the very individuals that later fill the need for high grade billets.

Therefore, since the career progression pipeline for the FFG 7 does not provide sufficient personnel for upward mobility, it cannot meet the FFG 7 demand for the higher rates. It would seem appropriate to initiate analyses in this area immediately so that alternative methods of coping with the situation can be developed.

DISCUSSION

Current Manning Level

The approved SMD for the FFG 7 now calls for 192 officers and enlisted personnel, including the LAMPS III aviation detachment. With a manning level of 199 or 225, including the aviation detachment and some growth, the complement is still smaller than that for the FFG 1 class (N = 241) or the FF 1052 class (N = 283). Although these ships are comparable to the FFG 7 in size and mission, they are sufficiently different as to preclude a direct comparison.

The FFG 7 has a low tolerance for degradation to designed manning levels. The Commander of Destroyer Squadron Nine and officers interviewed on board the FFG 7s expressed their belief that the FFG 7 class ships could meet their projected operational demands if the ships were manned in accordance with SMD specifications. They did not believe the FFG 7s could meet their operational commitments if manning in either quantity or quality dropped below the SMD figures.

Consolidated Manning Problems

Some fleet experiences to date with consolidated manning concepts have been negative. Examples are given below:

1. Condition III watchstations on the bridge may have to be increased (addition of JOOD, telephone talker, QMOW, and lookout on FFG 9).
2. The dedicated team concepts for facilities maintenance and integrated support functions in the galley have not proven feasible, and the ships have reverted to the more conventional method of assigning personnel to these functions.
3. Excessive workload problems have been identified in the areas of Supply and Administration. Interviewees generally agreed that a second supply department officer is required, and there is a common view that inport demands prevent the ship's force from accomplishing both ship's work and essential training.

Lessons Learned

1. Initial estimates of FFG 7 manpower requirements were too low, particularly those in the supply, support, and administration areas (otherwise known as own unit support.) In other words, conventional procedures for estimating and computing ship workload requirements have not produced a picture of actual resource requirements. This suggests that where austere manning is an objective, these procedures must be modified.
2. There is no evidence to suggest that, in the earliest phases of this program, projected manpower supply was considered in establishing the manning and accommodations constraint. There was no capability to offer decision makers the supply projection information that might have been used to establish design or acquisition policy.
3. The constraint on accommodations was levied before the possible effects of fair share manning and system modifications were recognized.
4. The constraint led to the acceptance of assumptions that could not be met.
5. The training, personnel planning, and support communities have not met the needs of the ships delivered thus far, even though the manpower constraints were established nearly a decade ago.

CONCLUSIONS

1. The decision to limit the number of accommodations to 185 was premature and did not allow for the changes that inevitably occur during design and development.
2. The assumption that each ship would be 100 percent manned by fully trained personnel at appropriate rates and ratings and with the requisite NECs was unrealistic. At present, newly delivered ships cannot be manned with enough trained and qualified personnel to ensure unrestricted operations at sea.
3. A capability for providing accurate manpower supply projections early in the design/development process is essential for sound acquisition and design decisions.

RECOMMENDATIONS

1. Force planners and acquisition managers should develop manpower projection techniques that consider the Navy's competing demands for manpower.
2. Designers should give serious consideration to the development of a built-in anti-air warfare simulator for the FFG 7 CIC.
3. The training establishment should analyze all onboard training needs and augment, where appropriate, the FFG 7's onboard training capability.
4. The shore training establishment should reexamine the training requirements for the FFG 7 class and ensure that enough fully trained personnel are made available to each ship prior to delivery.
5. The Navy should continue to monitor and evaluate the FFG 7 manning and performance closely. A plan of action and milestones should be developed for this purpose.

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